Section 2 Methods

2.1 Field Methods

The fieldwork component of the archaeological inventory survey investigation was carried out under archaeological permit number 09-20, issued by the Hawaiʻi State Historic Preservation Division/Department of Land and Natural Resources, per Hawaiʻi Administrative Rules Chapter 13-282. The CSH field crew included: Jeff Fong, M.A.; Matt McDermott, M.A.; David Shideler, M.A.; Jane Drengson, B.S.; Michelle Pammer, B.A.; Peter Moser-Samson, B.A.; Ena Sroat, B.A.; Douglas Thurman, B.A.; Jon Tulchin, B.A.; and Todd Tulchin, B.S.; under the general direction of Hallett H. Hammatt, Ph.D. Fieldwork was conducted between August 5 and October 14, 2009, and required approximately 125 person-days to complete.

2.1.1 Fieldwork Tasks

Fieldwork for this archaeological inventory survey investigation included the following:

1. Pedestrian survey of the Construction Phase I project area, including: the fixed guideway alignment; the East Kapolei, UH West Oʻahu, Hoʻopili, West Loch, Waipahu Transit Center, Leeward Community College, and Pearl Highlands stations; the East Kapolei, UH West Oʻahu, and Pearl Highlands park and ride facilities.
2. Backhoe-assisted testing within the Construction Phase I project area, including: select guideway column foundation locations; the East Kapolei, UH West Oʻahu, Hoʻopili, West Loch, Waipahu Transit Center, Leeward Community College, and Pearl Highlands stations; the East Kapolei, UH West Oʻahu, and Pearl Highlands park and ride facilities; and the vehicle maintenance and storage facility at the former U.S. Navy Ewa Drum Filling and Fuel Storage Area.
3. Ground penetrating radar (GPR) survey prior to backhoe-assisted testing within the Construction Phase I project area.

2.1.2 Pedestrian Survey

The pedestrian inspection of the Construction Phase I project area was accomplished through systematic sweeps. The interval between the archaeologists was generally 5 to 10 m. Along the major roads of the project area, archaeologists traversed the sidewalks and medians of the active thoroughfares. As previously discussed, identification and documentation of the project area’s architectural cultural resources, including historic roads, bridges, and structures, was conducted by historic architectural firm Mason Architects, Inc., in association with the project’s Environmental Impact Statement (EIS) (USDOT/FTA and C&C/DTS 2008).

2.1.3 Backhoe-Assisted Subsurface Testing

The backhoe-assisted subsurface testing program consisted of the excavation of 57 backhoe trenches and 35 column location test pits. In general, linear trenches measuring approximately 6 to 8 m long and 0.8 m wide were excavated at proposed station locations and rectangular test pits measuring approximately 2 by 2 m were excavated at guideway column foundation locations. Excavations were generally made to a depth of 2 m.

In general, test excavations were distributed throughout the project area to provide representative coverage and assess the stratigraphy and potential for subsurface cultural resources for the entire Construction Phase I project area. The reader is referred to the *Archaeological Inventory Survey Plan For Construction Phase I of the Honolulu High-Capacity Transit Corridor Project Station 392+00 (near East Kapolei Station) to Station 776+00 (near Waimano Home Road), Honouliuli, Hōʻaeʻae, Waikele, Waipiʻo, and Waiawa Ahupuaʻa, ʻEwa District, Oʻahu* (Hammatt and Shideler 2009) for the details of the excavation sampling strategy employed by this archaeological inventory survey. The sampling strategy was developed in consideration of soil types, natural geographic features, historic records (particularly Land Commission Award data), the results of previous archaeological studies in the vicinity, the results of consultation with the Native Hawaiian community, an assessment of the impact of prior land development, and a consideration of safety concerns for actually carrying out the archaeological work. Selection of the sample of guideway column foundations to undergo subsurface testing was primarily based on the relationship to commoner (*kuleana*) Land Commission Awards as indicators of areas of intensive traditional Hawaiian activity. A secondary factor in selection was consideration of the proximity of landscape features, particularly streams. Subsurface testing was also focused on the station locations due to the relatively high density of subsurface impacts related to the stations' construction, and also because the stations would be problematic to re-locate owing to geographical and engineering constraints.

Each test excavation was documented with a scale section profile, photographs, and sediment descriptions. Sediment descriptions, using standard USDA soil description observations/terminology, included: Munsell color designations; texture; consistency; structure; plasticity; cementation; origin of sediments; descriptions of any inclusions, such as cultural material and/or roots and rootlets; lower boundary distinctiveness and topography; and other general observations. Cultural features were represented on the trench profile. Feature documentation included profiles and/or plan views, collected samples, stratigraphic descriptions, and photographs. The location of each test excavation was recorded using a Trimble ProXH GPS unit (sub-foot horizontal accuracy). Following appropriate documentation and sampling, each test excavation was backfilled, compacted, and restored to its original state.

2.1.4 Ground Penetrating Radar Survey

The ground penetrating radar (GPR) survey was performed using a Geophysical Survey Systems, Inc. (GSSI) SIR-3000 system equipped with 400 MHz antenna. This is a bistatic system, in which electromagnetic energy in the radar frequency range is transmitted into the ground via a sending antenna. Radar energy is reflected off of the subsurface matrix and is then received by another, paired antenna. Reflected energy is sampled and the travel time (in nanoseconds) of the individual reflection waves is recorded. Wave propagation speed varies depending on the nature of the subsurface medium. Any changes in density or electromagnetic properties within the stratigraphic column may cause observable variations in reflection intensity. Reflection features may include discrete objects, stratigraphic layering, or other subsurface anomalies.

The GPR survey was conducted to determine the viability of GPR in determining stratigraphy and locating cultural deposits within the Construction Phase I project area. The effectiveness of GPR is highly dependent on local soil conditions. The high signal attenuation rate of many soil types restricts the depth of radar penetration and therefore limits the effectiveness of GPR surveys. The National Resource Conservation Service produced maps indicating the relative suitability of GPR applications throughout the U.S. The GPR suitability data was generated based on U.S. Department of Agriculture (USDA) soil survey data. Figure 9 shows the Construction Phase I project area on the NRCS GPR Suitability Map for Hawaiʻi. The project area is shown to traverse lands in the moderate to low suitability categories.

GPR survey for this project was conducted using single-run transects to generate two-dimensional (2D) depth profiles. GPR was conducted at locations selected for subsurface testing to prospect for subsurface anomalies and stratigraphic interfaces prior to excavation, as these could correspond to isolated archaeological features or sediments that are more likely to contain cultural deposits (i.e. buried A-horizons). Following the completion of subsurface testing, the documented stratigraphy was referenced against the GPR profiles to establish if there were patterns in the GPR data that may be associated with stratigraphic interfaces, sediment types, and subsurface features (i.e. trash pits, construction debris, etc.).

GPR data collection parameters (Table 1) were held constant throughout the survey under the assumption that soil conditions were relatively consistent across the study area. A dielectric constant[1] of 8 was utilized in anticipation of the presence of alluvial sediments (silts and clays) within the project area based on the USGS soil survey of the area (Foote et al. 1972). Estimated depth of view is 2 m.

All collected radar data was post-processed using RADAN 6.6 software. Position correction was utilized to remove unwanted surface "noise" from GPR profiles. Horizontal stretching was utilized in order to obtain greater detail for comparison with stratigraphic trench profiles. A Horizontal High Pass Finite Impulse Response "Boxcar" (Background Removal) filter was not utilized in order to retain the image of recorded stratigraphic layers.

Table 1. GPR Data Collection Parameters

Parameter	Settings
Antenna	400 MHz
Samples per Scan	512
Format	16-bit
Depth	2 meters
Dielectric	8
Soil	Type 2
Scans per Unit	50/m

[1] The measure of the ability of a material to store a charge from an applied electromagnetic field and then transmit that energy. In general, the greater the dielectric constant of a material, the slower radar energy will move through it. The dielectric constant is a measurement of how well radar energy will be transmitted to depth.

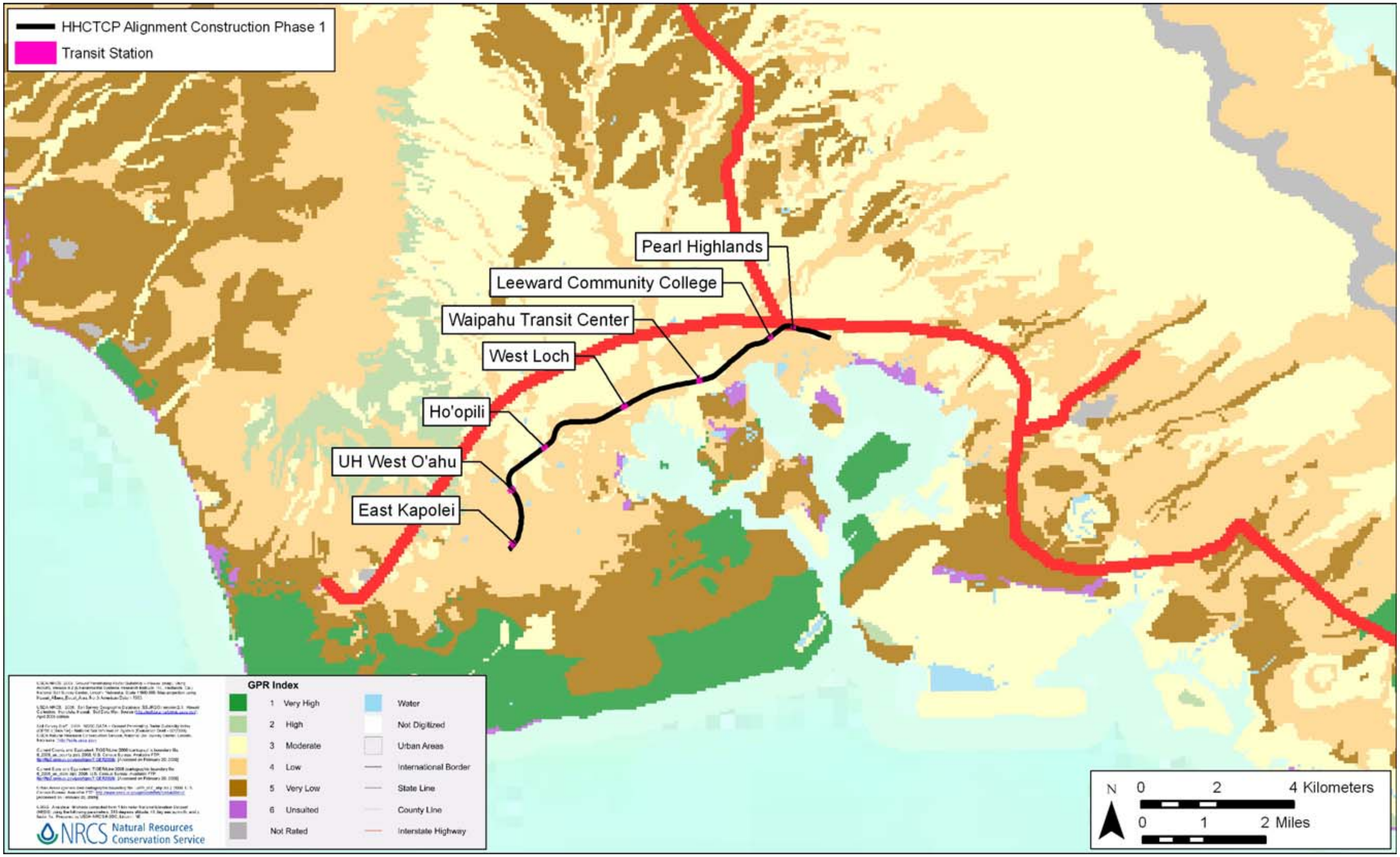

Figure 9. Ground penetrating radar (GPR) suitability map (source: National Resource Conservation Service) showing the project area

2.2 Document Review

Historic and archival research included information obtained from the UH Mānoa Hamilton Library, the State Historic Preservation Division Library, the Hawai‘i State Archives, the State Land Survey Division, and the Archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary historical sources. Information on Land Commission Awards was accessed through Waihona ‘Āina Corporation’s Māhele Data Base (www.waihona.com).

2.3 Laboratory Methods

Following the completion of fieldwork, all collected materials were analyzed using current standard archaeological laboratory techniques. Three samples of organically enriched sediment were sent to Beta Analytic, Inc. of Miami, Florida for radiocarbon dating analysis. All samples were analyzed using the Accelerator Mass Spectrometer (AMS) method. The conventional radiocarbon ages determined by Beta Analytic, Inc. were calibrated to calendar ages using the OxCal calibration program, Version 3.10, developed by the University of Oxford Radiocarbon Accelerator Unit (ORAU), and available as share-ware over the Internet (http://c14.arch.ox.ac.uk/**oxcal**.html). The results of the radiocarbon dating analysis are presented in Section 5: Results of Laboratory Analyses of this report.

Upon conclusion of the project all materials collected will remain curated at the Cultural Surveys Hawai‘i, Inc. office in Waimānalo, Oahu until a permanent curation facility is determined by the project proponents and SHPD/DLNR.